Section A.

Technical Notes

SCOPE OF SURVEY

Data presented in this report are collected annually through the National Science Foundation's (NSF's) congressionally mandated Survey of Federal Science and Engineering (S&E) Support to Universities, Colleges, and Nonprofit Institutions (the federal S&E support survey). The survey originated in 1965, when the Committee on Academic Science and Engineering (CASE) within the Federal Council for Science and Technology established the CASE data collection system to report annually on federal S&E obligations to academic institutions and associated federally funded research and development centers (FFRDCs). Since 1968, CASE data, as well as data on nonprofit institutions, also have served as the basis for an annual report to the President and Congress. This survey is designed to collect information from federal agencies on (1) total S&E program support to academic institutions, (2) total S&E support to federally funded research and development centers (FFRDCs) administered by academic institutions, and (3) research and development (R&D) and R&D plant support to nonprofit institutions and associated FFRDCs.

The data are presented in terms of federal obligations provided for direct support of academic S&E. The data exclude financial support of an indirect nature, such as funds allocated to state agencies, even if the final recipient of such funds is known to be an academic institution. Data on type of institutional control and on highest degree granted are not presented in this report but are available upon request (see "Data Availability" at the end of this section).

Obligations are the amounts for orders placed, contracts awarded, services received, and similar transactions during a given period, regardless of when the funds were appropriated and when future payment of money is required. Obligations differ from expenditures in that funds allocated by federal agencies during one fiscal year may be spent by the recipient institution either partially or entirely during one or more subsequent years.

The obligations listed for individual institutions reflect direct federal S&E support. Thus, amounts subcontracted to other institutions are included, but funds received through subcontract arrangements from prime contractors are excluded.

Obligations are listed as awards to individual institutions within a system (e.g., to the University of California, Los Angeles rather than to the University of California system as a whole). However, obligations awarded directly to the central administration of a system are listed separately. If the final destination of the funds is not known, the agencies report them as obligations to a system's administrative office from which the funds are distributed to the system's individual institutions.

CHANGES IN REPORTING

Since these data were first collected in 1965, there have been some changes in reporting. The most recent of these include the following:

- During the FY 1987 survey cycle, the Department of Defense (DoD) determined that some funds reported in prior years as R&D obligations to the Johns Hopkins University Applied Physics Lab (APL) were more appropriately classified as "other sciences and engineering." Data for FYs 1984 to 1986 were revised, but DoD was unable to revise data for earlier years. In FY 1997, APL accounted for more than 95 percent of DoD's total S&E funding of $323 million to Johns Hopkins.

- To better differentiate between that part of the federal R&D budget that supports "science and key enabling technologies" (including for military and nondefense applications) and that part that primarily concerns "testing and evaluation of large technical systems prior to production" (of mostly defense-related systems), NSF, has since FY 1994, collected data on DoD development dollars in two categories: advanced technology development and major systems development.

- Before FY 1993, NSF published data on a seventh obligations category (see "Categories of Support," below) covering non-S&E activity. Since then, however, the Department of Education has made major software modifications to the automated system from which its federal S&E data were produced. The revamped coding structure introduced major trend differences for the department's institution data. Consequently, because Education accounted for 91 percent ($5.9 billion) of the total federal support for "non-S&E" ($6.5 billion) for FY 1993, NSF no longer publishes non-S&E totals. To explain Education's downward academic R&D trend between FY 1993

and FY 1994 (from $95 million to $49 million), the agency stated that academic R&D programs in FY 1994 either were not funded, did not have an S&E component, or received reductions in funding.

Categories of Support

The data presented here include all obligations for academic S&E: this comprises federal obligations for R&D; R&D plant; facilities and equipment for S&E instruction; fellowships, traineeships, and training grants; general support for S&E; and other S&E activities. These support categories are defined below.

1. **R&D** includes all research activities, both basic and applied, and all development activities that are supported at universities and colleges. Demonstration projects conducted to discover whether a technology or method is workable are considered to be within the scope of R&D if their objective is to produce new information within a specific time period.

   R&D excludes topographic mapping and surveys, collection of general-purpose statistics, and activities concerned primarily with the dissemination of scientific information. Also excluded are routine product testing, quality control, and R&D facilities and fixed equipment.

   - **Research** is defined as systematic study directed toward fuller scientific knowledge or understanding of the subject studied. Research can be classified as basic or applied, although data reported here are not separated into these categories. In **basic research**, the investigation is oriented toward gaining a better knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications toward processes or products in mind. In **applied research**, the investigation is aimed at gaining the knowledge or understanding necessary for determining the means by which a recognized and specific need may be met.

   - **Development** is the systematic use of knowledge and understanding gained from research directed toward the production of useful materials, devices, systems, or methods; this includes the design and development of prototypes and processes.

   - **Research equipment** is included as part of R&D. It includes any item (or interrelated collection of items constituting a system) of nonexpendable tangible property or software with a useful life of more than 2 years and an acquisition cost of $500 or more that is used wholly or in part for research.

2. **R&D plant** includes all costs—direct, indirect, and related—of all projects with the main objective of providing support for the construction, acquisition, renovation, modification, repair, or rental of facilities, land, works, or equipment for use in S&E R&D. A facility is interpreted broadly to be any physical resource important to the conduct of R&D. Excluded are expendable research equipment and office furniture and equipment.

   As used here, R&D plant refers to large facilities and fixed equipment. Data on **research instrumentation** are not separately identifiable in this report. Research instrumentation funds are for equipment purchased under research project awards from current-fund accounts and are included under totals for R&D (see above).

3. **Facilities and equipment for S&E instruction** include all programs whose main purpose is providing support for the construction, acquisition, renovation, modification, repair, or rental of facilities, land, works, or equipment for use in instruction in S&E.

4. **Fellowships, traineeships, and training grants** include graduate programs in support of the development and maintenance of S&E personnel resources. The total amounts pertaining to such awards (stipends and cost-of-education allowances) are reported on the basis of the institution chosen by the recipient. Excluded are programs that support research and education institutes, seminars, and conferences such as teacher training activities provided through teacher institutes, short courses, research participation, and in-ser-

vice seminars; activities aimed at the development of education techniques and materials for use in S&E training; and programs that provide special opportunities for increasing the scientific knowledge and experience of precollege and undergraduate students. These activities are covered under "other science and engineering activities" (see category 6 below) if they are S&E-oriented.

5. **General support for S&E** includes programs that support nonspecific or generalized purposes related to scientific research and education. Such projects are generally oriented toward academic departments, institutes, or institutions as a whole. The support offered in this area ranges from that provided without any specification of purpose (other than that the funds be used for scientific projects) to that provided for activities within a specified field of S&E without a specific purpose. The National Institutes of Health's Biomedical Research Support Grants and Minority Biomedical Support Grants are examples of this support category.

6. **Other S&E activities** are those academic S&E activities that cannot be assigned to any of the preceding five categories, including support for technical conferences, teacher institutes, and activities aimed at increasing the scientific knowl edge of precollege and undergraduate students.

Types of Institutions

The types of institutions covered by this survey are universities and colleges, FFRDCs, and independent nonprofit institutions.

Universities and Colleges

Universities and colleges are those institutions of higher education in the United States that offer at least 1 year of college-level study leading toward a degree. The universe of academic institutions for this survey is derived from the higher education institution portion of the Department of Education's Integrated Postsecondary Education Data System (sponsored by the National Center for Education Statistics) and the *1998 Higher Education Directory* (published by Higher Education Publications, Inc.).

Institutions included are those that received federal S&E support during FY 1997. This support can have been provided to any part of the academic institution—its colleges (e.g., of liberal arts) and schools (e.g., of agriculture), professional schools, hospitals, agricultural experiment stations, bureaus, offices, and research centers (excluding FFRDCs), whether located on or off the main campus or at branch campuses controlled directly by the parent institution. Further, the institutions included must have a significant degree of academic and administrative autonomy. For example, institutions within a system (a group of institutions having a collective legal status and generally recognized by a state government, a board of education, or other relevant organization) in which a significant degree of autonomy remains at the individual institution level are presented separately; while obligations to branch campuses are included in the totals for the parent institutions. Obligations to the service academies and to the U.S. Department of Agriculture Graduate School are not included.

FFRDCs

FFRDCs are R&D-performing entities formed to meet a particular federal R&D objective that cannot be met effectively by existing organizational resources. FFRDCs range from the traditional contractor-owned/contractor-operated or government-owned/contractor-operated organizational structures to various degrees of contractor/government control and ownership. The data are presented here for university-administered FFRDCs and nonprofit-administered FFRDCs. For a complete list of FFRDCs see page 10.

Independent Nonprofit Institutions

Independent nonprofit institutions are legal entities other than universities and colleges, privately organized or chartered to serve the public interest, and exempt from most forms of federal taxation. Data presented for nonprofit institutions and for nonprofit-administered FFRDCs are obligations for R&D and R&D plant reported by as many as 20 participating agencies.

Coverage of the nonprofit sector in the federal S&E support survey was expanded beginning in the late 1970s to include all types of nonprofit institutions that receive federal R&D funds. For NSF's purposes, these types of institutions are defined as follows:

1. **Research institute:** A separately incorporated, independent nonprofit organization operating un-

der the direction of its own controlling body whose primary function is the performance of R&D in S&E.

2. **Voluntary hospital:** This is a member of the American Hospital Association not subject to the control of either federal, state, or local governments nor an integral part of any institution of higher education. Note that hospitals that have been set up by research institutes and that, although providing patient care, function primarily as laboratories for research institutes are themselves classified as research institutes.

3. **All other independent nonprofit institutions:**

   - **Professional or technical society or academy of science and engineering:** A voluntary association of individuals sharing a common interest in the advancement of knowledge—either within a single field or across a broad spectrum of disciplines—whose major function is to aid and encourage the collection, collation, and dis semination of S&E knowledge for the benefit of their members and the community as a whole.

   - **Private foundation:** A nongovernmental nonprofit organization, with a principal fund of its own managed by its own trustees or directors, established to maintain, aid, or facilitate social, educational, charitable, religious, or other activities serving the common welfare. Private foundations include operating foundations that allocate the greater proportion of their R&D budgets to intramural performance and philanthropic foundations that allocate most of their funds to grants and contracts for research to be performed extramurally.

   - **Science exhibitor:** A nonprofit organization whose primary goal is to expand scientific literacy within a community by providing exhibits that display and interpret the latest scientific findings within its field or fields. Included in this category are museums, zoos, botanical gardens, and arboretums.

   - **Trade association:** An organization of business competitors in a specific industry or business that is interested primarily in the commercial promotion of products or services. Membership is usually held in the name of a business entity. Activities may fall into one or more of the following areas: business ethics, management practices, standardization, commercial (statistical) research, publication, promotion, and public relations.

   - **Agricultural cooperative:** An organization of individuals or business entities that are normally competitors in the production and sale of agricultural products. Activities may fall into one or more of the following areas: collective marketing or purchasing, research, public relations, and improvement of economic conditions for the U.S. farm population.

Data Comparability With Other SRS Studies

Federal Funds for Research and Development

Data presented here on R&D and R&D plant by agency sometimes conflict significantly with similar data presented in the annual NSF survey, Federal Funds for Research and Development (or the "federal funds survey"). Much of the difference lies in the two surveys' treatment of interagency transfers. Interagency transfers of funds obligated to an academic or nonprofit institution are reported here by the agency that actually obligates the funds to the receiving institution. In the federal funds survey, however, obligations are reported by the agency in which the funds originated.

Other differences between the data compiled by the two surveys stem from the following factors:

1. **Agencies involved:** In the present survey, data are reported by as many as 20 federal agencies on their S&E obligations to institutions of higher education; these agencies together obligate virtually all federal support to academic R&D. For the federal funds survey, budget data on R&D and R&D plant are gathered from the 32 federal agencies with such programs.

2. **Scope of information:** Data collected in the federal S&E support survey pertain only to individual academic and nonprofit institutions. Those collected in the federal funds survey relate to all types of performers. Furthermore, federal funds survey data are detailed as to character of work (basic research, applied research, and develop-

ment); data from the federal S&E support survey are not comparably disaggregated.

3. **Data sources:** The two surveys rely on different sources of data and on different methods of data collection. For example, data for the federal S&E support survey are generally processed from award files; federal funds survey data are usually derived from agency budget documents.

4. **Preparer interpretations:** Several agencies rely on personnel from separate internal offices to respond to the two surveys. These respondents frequently differ in their interpretation of survey questions. The National Institutes of Health, for example, report Biomedical Research Support Grants under "general support for science and engineering" in the federal S&E support survey, but under "research and development" in the federal funds survey.

National Patterns of R&D Resources

NSF publishes one other report related to federal R&D funding, *National Patterns of R&D Resources*. This report provides statistics on U.S. R&D expenditures categorized by provider of funds (Federal government, nonfederal government, industry, academia, and nonprofit institutions), type of performer (Federal government, industry, academia, nonprofit institutions, and federally-funded research and development centers), and character of work (basic research, applied research, and development). In the report, R&D expenditure levels from Federal sources are based on performer-reported surveys, which differ from Federal R&D funding totals reported by the Federal agencies that provide those funds. During the past several years, these differences have widened. The difference in the Federal R&D totals appears to be concentrated in the funding of industry R&D by the Department of Defense. See *National Patterns of R&D Resources: 1996* (NSF 96-333) and the forthcoming *National Patterns of R&D Resources: 1998* for detailed discussion and documentation of these differences.

Data Availability

Federal Science and Engineering Support to Universities, Colleges, and Nonprofit Institutions

Data published in this report are also available on the World Wide Web. Information on file formats and the years for which they are available can be found at http://www.nsf.gov/sbe/srs/fedsuppt/start.htm.

Integrated Academic Science and Engineering Database

Public-use tapes from the Integrated Academic Science and Engineering Database are available for purchase and will normally be shipped within 3 working days from order receipt. Data tapes from the most recent surveys (1997) are currently available; contact . NSF's Division of Science Resources Studies at (703) 306-1772 to order.

Institutional Profiles

Selected data items for individual doctorate-granting institutions and schools with S&E departments that grant a master's degree are available on computer-generated institutional profiles. An institutional profile consists of data not only from this survey, but from NSF's other two academic S&E surveys: the Survey of Research and Development Expenditures at Universities and Colleges, and the Survey of Graduate Students and Postdoctorates in Science and Engineering.

WebCASPAR

Institutional researchers can obtain data from several academic S&E resources through the Web Computer-Aided Science Policy Analysis and Research (WebCASPAR) database system, which is an easy-to-use tool for the retrieval and analysis of statistical data on academic S&E resources. WebCASPAR provides an

extensive and growing data library with multiyear statistics on the state of higher education in general and on academic S&E resources specifically. This data library is based on a set of standard institutional and field-of-science definitions across the multiple sources used to develop the database. The WebCASPAR program includes built-in help capabilities to facilitate the use and interpretation of the data.

WebCASPAR data are drawn from a number of sources. All data are available for individual institutions, by state, and at the national level. Longitudinal data from surveys of universities and colleges conducted by NSF's Division of Science Resources Studies include the federal S&E support survey, academic R&D expenditures survey, federal funds survey, and graduate student survey cited above. Data from the Integrated Postsecondary Education Data System conducted by the National Center for Education Statistics are also included. Data from other sources include the National Research Council's assessment of research doctorate programs.

The latest version of WebCASPAR can be accessed via the World Wide Web at http://caspar.nsf.gov/webcaspar.

Federally Funded Research and Development Centers

The following is a list of federally funded research and development centers (FFRDCs) included in the Federal S&E support survey. The list is arranged by sponsoring agency and administering organization (in parentheses). Respondents reported under the FFRDC category funds that were obligated to the centers identified on this list.

Department of Defense

Office of the Secretary of Defense[1]

Administered by other nonprofit institutions[2]

Institute for Defense Analyses Studies and Analyses FFRDC (Institute for Defense Analyses), Alexandria, VA

Logistics Management Institute (Logistics Management Institute), McLean, VA[3]

National Defense Research Institute (RAND Corp.[4]), Santa Monica, CA

C3I Federally Funded Research and Development Center (MITRE Corp.5), Bedford, MA, and McLean, VA

Administered by universities and colleges[6]

Software Engineering Institute (Carnegie Mellon University), Pittsburgh, PA

National Security Agency

Administered by other nonprofit institutions[2]

Institute for Defense Analyses Communications and Computing Federally Funded Research and Development Center[7] (Institute for Defense Analyses), Alexandra, VA

Department of the Navy

Administered by other nonprofit institutions[2]

Center for Naval Analyses, (The CNA Corp.), Alexandria, VA

Department of the Air Force

Administered by universities and colleges[6]

Lincoln Laboratory (Massachusetts Institute of Technology), Lexington, MA

Administered by other nonprofit institutions[2]

Aerospace Federally Funded Research and Development Center (The Aerospace Corp.), El Segundo, CA

Project Air Force (RAND Corp.[4]), Santa Monica, CA

Department of the Army

Administered by other nonprofit institutions[2]

Arroyo Center (RAND Corp.[4]), Santa Monica, CA

Department of Energy

Administered by universities and colleges[6]

Ames Laboratory (Iowa State University of Science and Technology), Ames, IA

Argonne National Laboratory (University of Chicago), Argonne, IL

Brookhaven National Laboratory (Brookhaven Science Associates, Inc.[8]), Upton, Long Island, NY

Ernest Orlando Lawrence Berkeley National Laboratory (University of California), Berkeley, CA

Fermi National Accelerator Laboratory (Universities Research Association, Inc.), Batavia, IL

Lawrence Livermore National Laboratory (University of California), Livermore, CA

Los Alamos National Laboratory (University of California), Los Alamos, NM

Oak Ridge Institute for Science and Education (Oak Ridge Associated Universities, Inc.), Oak Ridge, TN

Princeton Plasma Physics Laboratory (Princeton University), Princeton, NJ

Stanford Linear Accelerator Center (Leland Stanford Junior University), Stanford, CA

Thomas Jefferson National Accelerator Facility[9] (Southeastern Universities Research Association, Inc.), Newport News, VA

Administered by other nonprofit institutions[2]
National Renewable Energy Laboratory[10] (Midwest Research Institute), Golden, CO

Pacific Northwest National Laboratory (Battelle Memorial Institute), Richland, WA

National Aeronautics and Space Administration

Jet Propulsion Laboratory (California Institute of Technology), Pasadena, CA

National Science Foundation

Administered by universities and colleges[6]
National Astronomy and Ionosphere Center (Cornell University), Arecibo, PR

National Center for Atmospheric Research (University Corp. for Atmospheric Research), Boulder, CO

National Optical Astronomy Observatories[11] (Association of Universities for Research in Astronomy, Inc.), Tucson, AZ

National Radio Astronomy Observatory (Associated Universities, Inc.), Green Bank, WV

Administered by other nonprofit institutions[2]
Critical Technologies Institute (RAND Corp.[4]), Washington, DC

Nuclear Regulatory Commission

Administered by other nonprofit institutions[2]
Center for Nuclear Waste Regulatory Analyses (Southwest Research Institute), San Antonio, TX

Department of Transportation
Federal Aviation Administration

Administered by other nonprofit institutions[2]
Center for Advanced Aviation System Development (MITRE Corp.[5]), McLean, VA

Department of the Treasury
Internal Revenue Service

Administered by other nonprofit institutions[2]
Tax Systems Modernization Institute (IIT Research Institute), Lanham, MD

Endnotes

1. In June 1997, the Office of the Secretary of Defense replaced the Defense Advanced Research Projects Agency as sponsor of the Software Engineering Institute.
2. That is, other than universities and colleges
3. Logistics Management Institute (LMI) moved from Bethesda, MD, to McLean, VA, in May 1994.
4. The following portions of the RAND Corp. are FFRDCs: Project Air Force, National Defense Research Institute (formerly Defense/Office of the Joint Chiefs of Staff), the Arroyo Center, and the Critical Technologies Institute. All other agency support to RAND is reported under nonprofit institutions.
5. Only the C3I Federally Funded Research and Development Center and the Center for Advanced Aviation System Development parts of the MITRE Corp. are FFRDCs. All other agency support to MITRE is reported under nonprofit institutions.
6. Includes university consortia
7. Although the Institute for Defense Analyses Communications and Computing FFRDC has been in existence since 1956, the Department of Defense added it to the Master Government List of FFRDCs for the first time in October 1995.
8. On March 1, 1998, Brookhaven National Laboratory acquired a new nonprofit administrator (Brookhaven Science Associates, Inc.). The previous administrator was a university consortium.
9. In May 1996 the name was changed from Continuous Electron Beam Accelerator Facility.
10. In September 1991 the name was changed from Solar Energy Research Institute.
11. Since February 1984 this center has included three former FFRDCs: Cerro Tololo Inter-American Observatory, Kitt Peak National Observatory, and the National Solar Observatory (formerly Sacramento Peak Observatory).

NOTES: The Department of the Army decertified the Institute for Advanced Technology (University of Texas), Austin, TX, as an FFRDC in November 1993. All obligations previously reported to this institution should be reported under universities and colleges.

The Department of Energy removed the Inhalation Toxicology Research Institute from the Master Government List of FFRDCs in May 1996.